Industrial Standardization

and Commercial Standards Monthly

September

New Inspection Code to Promote Uniform Motor Vehicle Requirements

(See Article on Page 217)

1939

Standardization and Progress

From an editorial by A. E. Rylander in the Tool Engineer for February, 1939

STANDARDIZATION is utterly essential to our modern, complex civilization. The automobile that is built in Detroit must be serviced anywhere on the globe, there must be spare parts to replace any unit that fails in operation. Yet, automobiles are being made more beautiful, more convenient and efficient, far safer; there is progressive development, as there is evolutionary progress in all of the arts of manufacture, as there is evolution even in products of the soil and in the breeding of cattle. Standardization with evolutionary progress. Sounds fantastic, doesn't it? Yet, in this age, we couldn't have the one without the other, for, there must be some basic norm, like the precision gage blocks, to serve as a comparator. "This is our ideal of perfection today, we will use it as a basis until a new norm is proven."

Music has long been standardized, so that an opera written in Italy can be sung anywhere; drawings are standardized, so that a machine designed in Hartford can be built wherever there are machine tools and the men to operate them; and even the fuels and lubricants for our engines are standardized, and so on ad infinitum. Yet, there is infinite room for originality. The eight notes of the scale combine into lilting aria or sonorous chorus, the three primary colors into endless range of shade, but a tithe of our vocabularies are potential of masterpieces of literature. Apparently, then, standardization is not a barrier to progress.

The danger of standardization lies in that we may become satisfied, that we may be content to rest on our laurels. It has happened before that humans have become content, and like the Chinese, the progenitors of many of our modern arts, have remained in a state of suspended civilization while the rest of the world marched on.

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RUTH E. MASON, *Editor*

This Issue

Our Front Cover: **Autos streaming down the ramp from the Pulaski Skyway toward the entrance to the Holland Tunnel. Standard inspection requirements are expected to help keep these cars in good operating condition. Photo by Charles Phelps Cushing.**

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Standardization is dynamic, not static. It means not to stand still, but to move forward together.

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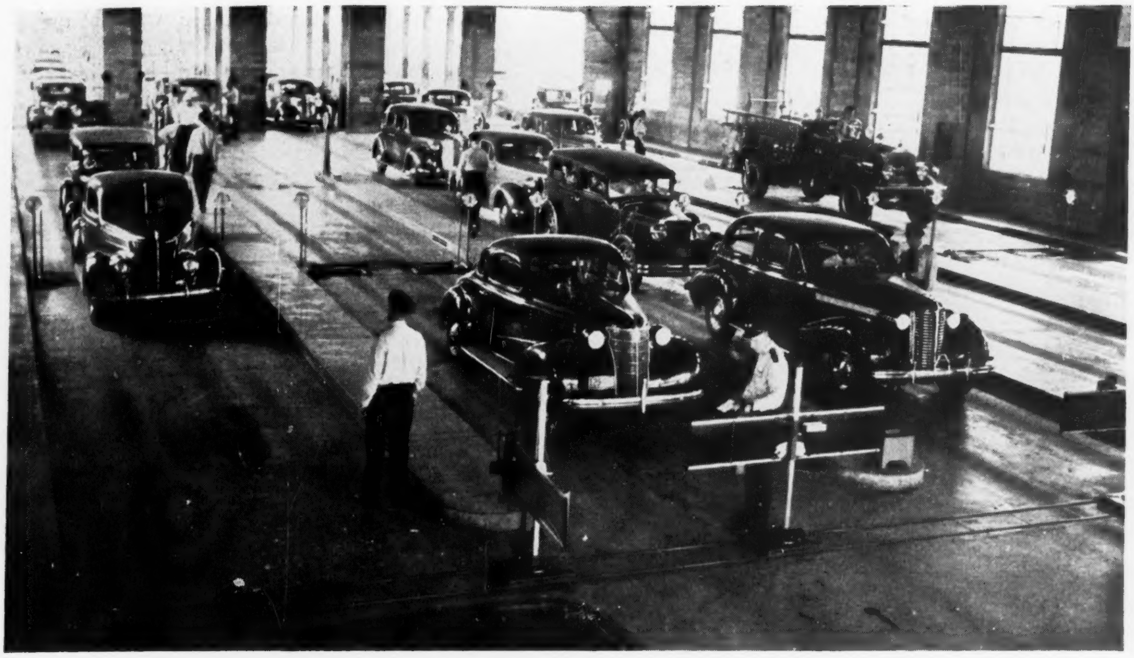

New standard, based on scientific data, tells how to inspect motor vehicles to increase efficiency and promote safety. Uniform requirements for all inspection stations is goal.

This picture shows the inspection station at Portland, Oregon, with headlight testers in the foreground, brake testers in center of picture, wheel alignment indicators in background.

New Standards for Motor Vehicle Inspection

by

Sidney J. Williams[1]

Chairman, Sectional Committee on American Standard Inspection Requirements for Motor Vehicles

BETTER vehicle maintenance is one of the fronts on which definite progress has been made in the campaign against traffic accidents. Manufacturers and dealers are urging customers to have their cars checked frequently. Among large truck and bus fleets "preventive maintenance" is the order of the day. And some twenty states, as well as numerous cities, now require periodic inspection of all motor vehicles either at publicly or at privately operated stations.

What percentage of traffic accidents is caused by mechanical defects? This frequent question cannot be answered with accuracy, not only because of inadequate accident reporting but because defective brakes, headlights, or other equipment is seldom the sole cause. It is generally accompanied by some careless act on the part of a driver or a pedestrian. A skillful driver *can* drive safely with no brakes or headlights to speak of—if he takes enough pains to keep out of tight places. But if he gets in a tight place, as most of us do at times, then any lack of caution or of skill is magnified in its results by imperfect performance of the vehicle.

Official reports for 1938, as compiled by the National Safety Council, show that only seven per cent of the motor vehicles involved in fatal accidents were reported as defective. A careful

[1]Director, Public Safety Division, National Safety Council.

study made several years ago indicated that such defects were at least a contributing factor in 15 per cent of the accidents. It is hardly possible that either figure includes all the cases where a driver got into trouble because his brakes did not perform perfectly at the crucial moment, or because his headlamps were dirty or not properly aimed and he could not see the highway ahead, or because he was blinded by some one else's headlights, or because he ran off the road when a worn tire blew out, or because some other of the innumerable parts in that complex and marvelous mechanism, the modern automobile, was not quite up to par.

Whether any such accident should be "charged" to the mechanical defect or to the driver for taking foolish chances is hardly worth debating. From the safety standpoint it is enough to know that, other things being equal, the better the condition of the car the better the driver can control it and the less likely he is to have an accident. We do know that, in state after state, inspections have shown that more than half the cars fail to meet reasonable requirements. The

Representative Committee Prepares Standard Inspection Requirements

A widely representative committee, bringing together automobile manufacturers, automotive engineers, inspection engineers, and automobile, bus, and truck operators, recommended the approval of the standard inspection requirements to the American Standards Association. The committee carried out its work under the leadership of the American Association of Motor Vehicle Administrators and the National Conservation Bureau. The members of the committee are:

Sidney J. Williams*, National Safety Council, *Chairman

Dr. Miller McClintock*, Bureau of Street Traffic Research of Yale University, *Vice-Chairman

Arthur Magee*, American Association of Motor Vehicle Administrators, *Vice-Chairman

Harold F. Hammond*, Institute of Traffic Engineers, *Secretary

Wilfred E. Brown*, National Conservation Bureau, *Technical Secretary

American Association of Motor Vehicle Administrators, *Arthur Magee, Jim Shanley (alt.)*
National Conservation Bureau, *H. W. Heinrich, W. S. Paine (alt.), Dan L. Royer (alt.)*
American Association of State Highway Officials, *Robert M. Reindollar*
American Automobile Association, *Burton W. Marsh, J. R. Crossley (alt.)*
American Mutual Alliance, *George H. Chapman, James C. Wilson (alt.), S. E. Whiting, Dwight McCracken (alt.)*
American Petroleum Institute, *T. L. Preble, J. F. Winchester (alt.)*
American Transit Association, *Martin Schreiber, A. A. Lyman (alt.)*
American Trucking Associations, Inc., *J. F. Winchester, W. F. Banks (alt.)*
Automobile Manufacturers Association, *David C. Fenner, Norman A. Damon (alt.)*
Automotive Parts and Equipment Manufacturers, Inc., *David Beecroft, Clarence O. Skinner (alt.)*
Bureau for Street Traffic Research, Yale University, *Miller McClintock, Maxwell Halsey (alt.)*
Electrical Testing Laboratories, *H. H. Millar, William F. Little (alt.)*
Illuminating Engineering Society, *R. N. Falge, G. W. Keown (alt.)*
Inland Marine Underwriters Association, *E. J. Perrin, J. P. Mayer (alt.)*
Institute of Traffic Engineers, *Dwight McCracken, H. F. Hammond (alt.)*
International Association of Chiefs of Police, *F. M. Kreml*
Interstate Commerce Commission, *H. H. Kelly, H. H. Allen (alt.)*
Motor and Equipment Manufacturers Association, *David Beecroft*
Motor and Equipment Wholesalers Association, *B. W. Ruark*
Motor Truck Association of America, Inc., *T. D. Pratt, Clinton Brettell (alt.)*
National Association of Motor Bus Operators, *Martin Schreiber, W. A. Duvall (alt.)*
National Association of Railroad and Utilities Commissioners, *P. S. Stahlnecker*
National Automobile Underwriters Association, *J. Ross Moore*
National Bureau of Standards, *H. C. Dickinson*
National Fire Protection Association, *H. L. Miner*
National Safety Council, *S. J. Williams*
Rubber Manufacturers Association, Inc., *A. L. Viles*
Society of Automobile Engineers, *A. J. Schamehorn, T. C. Smith (alt.)*
Telephone Group, *T. C. Smith, A. L. Stadermann (alt.)*
Underwriters' Laboratories, Inc., *S. V. James Charles W. Rulon (alt.)*
U. S. Department of Agriculture—Bureau of Public Roads, *J. Trueman Thompson*

Motor Vehicle Inspection Code Committee did not have to determine exactly how important vehicle condition is in causing or preventing accidents; it was enough to know that vehicle condition is a substantial factor and that millions of vehicles are operated daily on the highways in a condition that no automobile mechanic, no competent driver, would regard as satisfactory.

Periodic Inspections Growing

Even more important, the committee knew that, in fact, a growing number of states and cities are subjecting all vehicles registered within their borders to periodic (generally semi-annual) inspection and that the inspection standards in the various jurisdictions are far from uniform and often vague. A vehicle does not become safe or unsafe merely by crossing an imaginary state or city boundary. The situation clearly calls for standardization of requirements for car performance.

Most if not all the committee members were convinced that periodic compulsory inspection, properly conducted, at stations which are well constructed, well equipped, and well manned, is of benefit in at least three ways: (1) by raising the average level of vehicle condition of the highway; (2) by educating the public to the importance of maintenance; and (3) by raising the standard of repair and maintenance work in garages. The committee as such, however, was not formulating or even recommending an inspection law. It was dealing with a condition, not a theory: the condition that hundreds of publicly operated inspection stations and thousands of private garages are now inspecting cars and trucks under legal mandates and that all of us will benefit by reasonable, uniform standards for headlights, steering apparatus, tires, wheel alignment, and other car performance related to safety.

Scientific Data Needed

At the outset the committee recognized that there was a dearth of scientific data on which to base valid standards, and that any standard arrived at by averaging opinions or guesses would be of little value. It therefore requested the National Conservation Bureau, as one of the sponsors, to undertake a research on items where data were lacking. The extremely valuable studies made by Wilfred Brown, employed by the Bureau for this purpose, are described by him in the article on page 220. The data thus developed were indispensable in formulating the code.

The subject was divided into four parts:

1. *Brakes*—deceleration, or stopping distance from a specified speed; equalization as between right and left wheels on one axle, and relation of braking effort as between front and rear wheels; and related items.

2. *Headlights*—output, focus, and aim, both horizontal and vertical, for single and multiple beam headlamps of various types; condition of bulbs, reflectors, lenses and so on.

3. *Tires and wheel alignment*—definition of when a tire becomes unsafe by reason of wear or injury; allowable side slip; steering wheel play and condition of steering apparatus in general.

4. *Accessories and miscellaneous* — covering mirrors, horns, wipers, mufflers and other equipment.

Each of these four sections was assigned to a subcommittee. The subcommittee chairmen and

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"A skillful driver *can* drive safely with no brakes or headlights to speak of—if he takes enough pains to keep out of tight places. But if he gets in a tight place, as most of us do at times, then any lack of caution or of skill is magnified in its results by imperfect performance of the vehicle," says Sidney Williams.

Periodic inspection required by 20 states and many cities extends to the individual automobile operator the "preventive maintenance" carried on voluntarily by large truck and bus fleets as sound economic procedure. Such inspection has already reduced the number of defective vehicles reported in accidents, according to a report from Evanston, Illinois, which has operated an inspection station since 1935. For the three years from 1932-1934, 4.7 per cent of the vehicles involved in accidents were defective, the Evanston report shows, whereas for the three and one-half years during which the inspection station was in operation and for which reports are available (from 1935 through June, 1938) the percentage of defective vehicles involved in accidents was reduced to 1.6 per cent.

"This is the more striking," Mr. Williams comments, "because with constantly improved methods of investigation, even if the percentage of defective vehicles actually remained constant, one would expect an increasing percentage of vehicles *discovered* to be defective."

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members, as well as secretary Harold Hammond and engineer Wilfred Brown, contributed many hours of hard work to the task.

Each subcommittee first surveyed its field, determined what it would tentatively agree upon, and what questions required study. Missing data were collected, through study of existing records and through original researches where needed. A few months ago, three of the four subcommittees completed their reports. These were discussed and accepted by the committee as a whole and were combined and edited to form a harmonious code which, after further discussion and revision, was finally adopted by a practically unanimous vote of the committee and submitted to the ASA.

In this final formulation an introductory section was added dealing with the set-up and operation of the inspection station as a whole. This was done because of the committee's belief that an inspection station that looks as if it had been thrown together overnight, and is manned by untrained, incompetent personnel, cannot function effectively, no matter how closely it may conform with standard criteria in the several inspection steps.

The code is thus complete except for one extremely important subject—brakes. This subcommittee, in its preliminary inquiry, found no general agreement either on what the standards of brake performance should be, or on adequate methods of testing for such performance. It recommended, and the main committee adopted the recommendation, that a thorough research on brake performance and brake testing as related to safety should precede the formulation of a standard. This research, now being started, has already yielded valuable information, but it may be a year or more before enough data are obtained to justify writing a brake section of the code. Meanwhile inquirers are perforce referred to the brake inspection standards now used by the leading inspection systems.

How Research Formed the Basis For New Inspection Requirements

by

Wilfred E. Brown[1]

Research Engineer, Traffic Division, National Conservation Bureau

SEVENTEEN states at present have motor vehicle inspection programs and nine cities operate their own municipal inspection stations. As the number of states and cities which adopt motor vehicle inspection grows larger, the need for the standardization of inspection requirement and practices becomes increasingly more urgent. A recent survey indicated that there are about as many procedures used in inspection stations as there are number of stations. It is apparent that a code of standards for inspection is needed at this time. As explained by Mr. Williams in his article on page 217, this need has been recognized and a motor vehicle inspection code has now been completed by a committee of the American Standards Association.

The first step in the work of preparing the new Code was to explore the inspection field. It was realized that in order to establish practical standards, all conclusions would have to be based on facts. The data available on the subject, however, were very meager. Nevertheless, all the agencies represented on the committee were anxious to cooperate, which made it possible to conduct the necessary research.

A questionnaire was sent to insurance field engineers wherever motor vehicle inspection was being carried on, asking how many inspections they made each year, how many inspection lanes they had, what were the general requirements for their inspection station, about the general routine followed within the station, the tolerances allowed in the inspection of each item, the

[1]The National Conservation Bureau has cooperated in the work of the ASA committee by making it possible for Mr. Brown to give much of his time for the past two years to the research work needed in the development of the standard.

type of equipment used, etc. Each engineer visited the inspection stations in his locality and filled out a questionnaire for each station. All information received was then summarized and presented to the respective subcommittee for consideration. Probably the most significant revelation of this survey was the wide variation and inconsistency in the procedures followed in different localities. Frequently, different stations within the same state were found to be operating under different standards. The survey gave a general picture of inspection methods throughout the United States.

Along with the collection of this information by questionnaire, the author visited most of the leading inspection station in the East and Midwest, observing the systems used and discussing inspection problems with the station supervisors.

The questionnaire and the personal visits made it possible to determine what type of standards would be needed, and the information thus obtained was turned over to the various subcommittees for use in planning their work. After the subcommittees had determined the major problems to be considered in their respective fields, the next step was to make plans and gather data covering controversial points. The lighting committee, for instance, found that standards were needed for the minimum of light necessary to operate a vehicle safely at night, for the proper aiming of the lamps to reduce glare to a minimum, and afford the best vision, and that it would be necessary to study the various means of checking the aim of headlamps. Committee members held several meetings with representatives of headlight manufacturers and testing laboratories and themselves conducted tests. Cars with every type of headlamp were brought in and the headlamps were checked under laboratory conditions by means of commercial headlight testers and by the screen method at 25 feet. Data were gathered and analyzed to show the limitations of the testing equipment under different conditions, and as a result of the tests several improvements were made on headlight testing apparatus. This information enabled the committee to prepare a reasonable and practical set of standards.

Manufacturers Send Data

Meantime the subcommittees on Tires, Wheels and Wheel Alignment and on Accessories and Miscellaneous Equipment had also gathered information from many sources. Upon request, manufacturers, users, and others submitted summaries of their safety experiences over a period of years. The subcommittees held numerous meetings to consider the information thus obtained and its bearing on the safe operation of vehicles.

A front wheel is inspected for looseness of bearing, shackles, and other defects

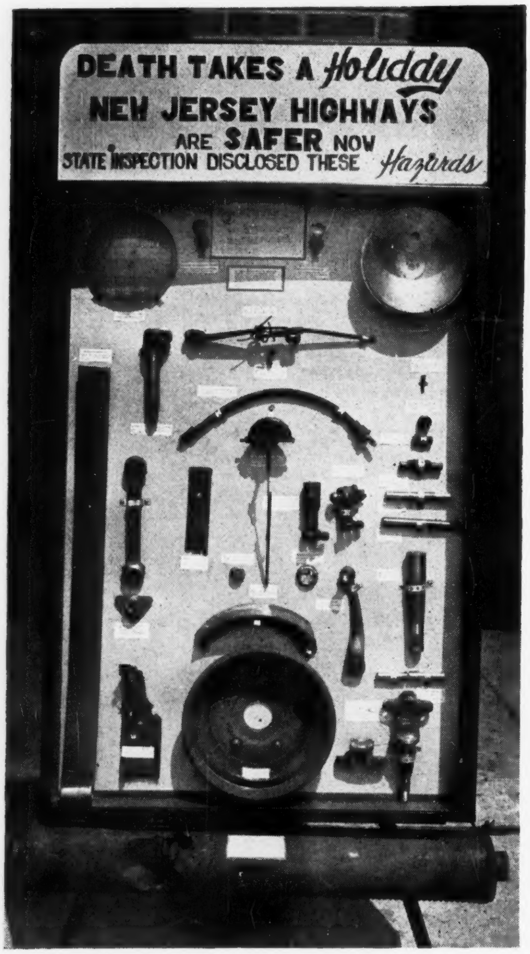
Accident statistics were studied to determine the relation between mechanical condition of vehicles and accident hazards. On the basis of the available data, codes were prepared by the subcommittees.

The brake section of the code is still in the process of development. For the past year intensive research work has been conducted on passenger cars and trucks to determine brake performance and how it can be measured. The National Conservation Bureau carried on this work for the subcommittee with the cooperation of the General Motors Proving Grounds, Ford Motor Company, Chrysler Corporation, International Harvester Company and Mack Trucks, Incorporated. The problem of brakes is a very complicated one in which many factors are involved. Nearly every vehicle becomes an individual case. In order to set up standards which will be fair to the public and contribute to safety, the American Standards Association brake subcommittee has joined hands with a similar committee of the Society of Automotive Engineers in an extensive research to study brake testing of both commercial and passenger vehicles. It is expected that about one year will be required to accumulate and analyze sufficient data on which to base brake testing standards.

Advancements in design and improvement of new equipment, experience of inspection stations in testing motor vehicles, and improved accident statistics, will all contribute toward the development of a new fund of information which may indicate the necessity for future revisions. The committee, therefore, appreciates the fact that its problem is not finished, but is a continuing one. It will undoubtedly carry on whatever research may be necessary in the future in order to keep the code in line with changing conditions.

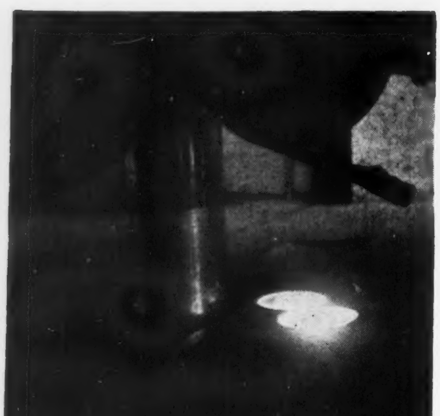
What Motor Vehicle Inspectors Find

By locating possible defects in their early stages, periodic inspection saves motorists expense as well as the danger of driving with a defective car. Some of the defects which have been found by inspection stations are shown on this page.



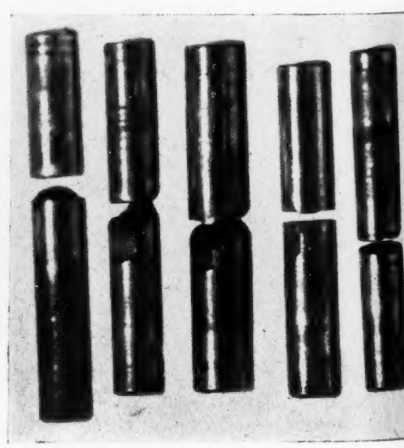
This board on display at an inspection station shows worn and broken parts—found during inspection. They range from a defective lens to a leaking muffler which was flooding a truck cab with deadly carbon monoxide.

Many tierods can be lifted off without effort, but this one fell off



Hose trouble *(left to right)*: Clogged hydraulic brake hose — Collapsed vacuum brake hose—Windshield wiper hose eaten through by a mouse resident behind the instrument panel

Broken steering spindle bolts are all too commonplace



Truck Operators See Benefit In Standard Inspection Code

by

Charles G. Morgan, Jr.

Manager, Division of Operations, American Trucking Association, Inc.

THE adoption of a code, or standard, of motor vehicle inspection under ASA auspices has many factors of potential benefit to owners of motor trucks throughout the country. First, of course, is the use of such a standard as a guide in making individual inspections where the fleet is of sufficient size to have its own maintenance crew and its own shops.

Truck fleet owners have long since learned that safety is a synonym for economy and efficiency of operation, and that one of the important cogs in the wheel of safety is a system whereby frequent, accurate, and searching inspection of the vehicles is carried out.

The use of the so-called "safety line" of inspection devices is spreading in the trucking industry, and in some instances of over-the-road, long-distance operation equipment is put through the line after every trip. This practice is found to have reduced maintenance and operating costs materially.

Standards Help Fleet Owners

The adoption of a standard of inspection, and use of such a standard by state and city inspection stations, will afford fleet owners an opportunity to check up on their own inspection and maintenance departments. This has already happened in many instances and the state safety line inspection has disclosed oversights or carelessness in the fleet maintenance set-up.

For the small operator it affords a means of frequently checking on the condition of his equipment at a nominal fee rather than going to a public garage for such an inspection. The small operator who has access to a public inspection station can, through the use of such facilities, ascertain what repairs or adjustments are actually needed and thus definitely order certain work done, rather than depend on the public garage to do "whatever may be necessary."

Owners of motor trucks, and more particularly insurance companies underwriting public-liability and property-damage insurance on such equipment, frequently find it advisable to settle claims for damages because of the difficulty of convincing a jury concerning the responsibility for the accident. When the time comes that vehicles may be inspected frequently in accordance with a nationally approved and accepted standard of inspection for safety, it may be possible to defend some of these unjust suits for damages and relieve the trucking industry of a burden of expense under which it now labors. All too often the accidents in which motor trucks are involved are caused by the unsafe operation of private automobiles, but are paid for by truck owners because juries are biased in their judgment, and forceful evidence of the safe condition of the motor truck is lacking.

In the case of trucks which have recently passed through a standard inspection, accepted and approved as assuring basically the safe operating condition of such vehicles, it may not be so difficult to defend fraudulent suits in the courts.

Of course, every owner of motor trucks is not entirely safety-conscious. There are backward members of every industry. The adoption of a standard for motor vehicle inspection, and its uniform use throughout the country in state or city inspections of motor vehicles, should assist materially in fostering greater safety in the trucking industry by at least forcing backward operators to bring their equipment up to the minimum standards for safe operation now accepted by more progressive and safety-conscious truck owners.

ICC to Add Inspection Requirements

In this connection it may be of interest to note that revised safety regulations of the Interstate Commerce Commission, effective for carriers by motor vehicle in interstate commerce after January 1, 1940, will for the first time include requirements for a minimum program of inspection and maintenance. The acceptance nationally of standards of inspection may be helpful in the further development of these regulations.

Motor Bus Operators Find Economy In Standard Maintenance Programs

by

A. W. Koehler

Secretary-Manager, National Association of Motor Bus Operators

THE part which faulty equipment, due either to design or improper maintenance, has played in traffic fatalities and serious accidents has always been a question.

It is generally accepted that perhaps not more than 10 percent of all traffic fatalities can be directly attributed to faulty equipment. In many cases where a vehicle is involved in an accident resulting in a fatality or serious personal injuries the vehicle itself is so badly damaged as to destroy evidence that would indicate whether or not its mechanical condition was a primary factor in the accident.

There are doubtless an appreciable number of accidents in which the mechanical condition of the vehicle was, however, an important contributing factor.

In the design and construction of our present-day common-carrier buses is reflected the best judgment of the automobile manufacturer based on years of experience in the laboratory and on the road. These buses come to the operator equipped with the latest and best mechanical equipment that the ingenuity of the automotive engineer can devise. They are carefully inspected at regular intervals and so maintained as to operate with maximum efficiency and safety.

Moreover all buses and trucks operated in interstate commerce are subject to the safety regulations of the Interstate Commerce Commission. Mechanical equipment standards are an important part of the Commission's safety regulations.

Many bus operators have competed for a number of years in a Maintenance contest conducted by the magazine *Bus Transportation* to focus attention on the importance of proper maintenance. The results have been very gratifying.

Experience in the states and municipalities which have adopted periodic inspection of privately owned and operated motor vehicles shows that in general the owner of a private car does not maintain it anywhere nearly so carefully as does the commercial operator.

Operating, as he does, every day of the year in all kinds of weather and in all kinds of traffic conditions the driver of a motor bus is constantly mingling in the traffic pattern. So long as other vehicles are not required, as a condition precedent to operation, to be in safe mechanical condtion, the bus driver and his passengers are subjected to hazards which should not be permitted.

The universal adoption of the new Motor Vehicle Inspection Code should assist materially in removing those hazards by insuring that all vehicles on the road are in at least a reasonably safe mechanical condition.

Motor Vehicle Administrators Welcome New Inspection Code

by

Arthur W. Magee

Commissioner of Motor Vehicles of New Jersey and President, American Association of Motor Vehicle Administrators

THE new Code for Inspection of Motor Vehicles is of interest to all Motor Vehicle Administrators, but it is particularly welcome to those Administrators who have been charged with the duty of conducting periodic inspections of motor vehicles.

For over a decade, periodic inspections of motor vehicles have been conducted in numerous jur-

isdictions throughout the country. Different methods have been employed with varying degrees of success. Without question, some of the least successful inspection programs have been handicapped because of the methods used.

There is now ample evidence that an all too large percentage of owners will not maintain their vehicles in a reasonably safe condition except by compulsion, and you cannot gloss over the fact that handsome dividends in increased highway safety result when vehicles are well maintained.

Inspection, whether had in a municipality or in a State, must, of necessity, be compulsory with everyone treated alike. Such universal compulsion can be had only through proper legislation and under governmental auspices. Any governmental function, to be successful, must have reasonably complete public acceptance. One of the prime requisites for the securing of such acceptance is the use of demonstrated good practices. The new American Standard Code for Inspection of Motor Vehicles is a veritable thesaurus of such practices.

Practicable uniformity has long been the goal of Motor Vehicle Administrators everywhere, and the new Code paves the way for nation-wide uniformity of inspection procedure.

McCall's Sponsors Research Institute for Testing Advertised Products

A Scientific Research Institute for Testing, to give magazines and newspapers a seal of approval which they can grant to manufacturers and advertisers whose products meet tests and specifications, is being proposed by Avraham Mezerik, sponsored by *McCall's Magazine*.

The plan, which is already getting under way, calls for an agreement on the part of recognized commercial testing laboratories to test products submitted by advertisers, and to return 15 per cent of the fees they receive to the Institute. National consumer organizations will be asked to join the Institute at a nominal membership fee. The tests would be based on standards and testing procedures agreed upon by the consumers and commercial testing laboratories, according to an announcement of the new plan in the August 15 issue of *Tide*.

"The standards and testing procedures worked out by the consumers and commercial testing laboratories—perhaps later counseled by a group with the stature of the American Standards Association—would likely be set up to certify performance and quality within arbitrary price ranges," says the *Tide* announcement. "Products would be rated either acceptable or unacceptable, not be rated competitively. There'd be no publicity for unacceptable products. For the time being the Institute would concentrate on home equipment and food products, keep hands off cosmetics and drugs until the present muddy question of standards in those groups has had further clarification in Washington.

"Current step is to go to advertisers, see if they can be persuaded to join. Each one is to pay the expense of having his own products tested."

"This project," says Otis L. Wiese, editor of *McCall's*, "is not designed to be an exclusive McCall's device. McCall's interest will be no greater or less than other participating publishers who meet Institute requirements."

One requirement will be that other publications which join the plan will share the operating costs of the Institute. Advertisers will pay for their own tests, hence the publications will handle only the administration costs.

Motor Vehicle Administrators Vote for National Traffic Standards

The American Association of Motor Vehicle Administrators went on record at its Annual Meeting in New York August 21-23 on behalf of national uniformity in traffic regulations and requested its Executive Committee to cooperate with the American Standards Association to develop a set of national traffic standards.

The following resolution was adopted by the Association:

***Resolved:* That uniformity in traffic standards and in administrative methods between highway regulatory jurisdictions is not only desirable but essential if a genuine and permanent solution of the present highway traffic problem is to be obtained; in the opinion of this Association it is extremely desirable that the facilities and experience of the American Standards Association in this field be used to develop a set of national traffic standards which will command the support of all the groups concerned; and to this end, the Executive Committee of this Association is requested to cooperate with the American Standards Association in the development of such a project.**

New Types of Fittings Covered In Revised Piping Standard

by

F. H. Morehead[1]

Chairman, Subcommittee 2 on Screwed Fittings, ASA Committee on Pipe Flanges and Fittings (B16)

THE American Tentative Standard for 150-Pound Flat Band Malleable Iron Threaded Fittings has been one of the most widely used of the B16 series of standards. Originally published in 1927, reprints were necessary in 1931 and 1936. Now a revised edition has been completed and approved by the American Standards Association as an American Standard.

For many years before the tentative standard was drawn up, malleable-iron screwed fittings were furnished to a great variety of dimensions and weights. This was particularly true of fittings having more than one size of connecting ends. Pipe-thread lengths for a given size were not consistent, and straight threads instead of taper thread were often used in the smaller sizes of fittings. In the tentative standard, therefore, detailed dimensions for threads, wall thicknesses, center-to-end, for example, were lined up to give a uniform graduation of dimensions according to pipe size.

Previous to standardization there had developed a gradual change in demand from plain fittings without bands to fittings reinforced by round bands or flat bands at the pipe ends. This made a stronger fitting, better able to withstand the strains incident to making up in pipelines.

Flat Band Type Considered

By 1921 when the work of standardization was begun, the preference for flat band type had crystallized to such an extent that the committee decided to consider this type only. The tentative standard included straight sizes of 90 and 45-degree elbows, tees, crosses; 45-degree Y-branches, service or street tees; and 90 and 45-degree elbows, couplings, reducers, caps, and return bends of closed, medium, and open patterns. In addition, the most commonly used sizes of reducing 90-degree elbows, tees, and crosses were included. Altogether, more than 460 individual fittings were detailed.

In response to a demand from industry, ASA Committee B16 on Standardization of Pipe Flanges and Fittings recently completed a revised edition. In this revision, the Introductory Notes now include minimum specifications for materials (ASTM A-197) which were not available for the earlier edition. Hydraulic ratings have been added, as well as tolerances on metal thickness and variation in alignment of threads.

New types of fittings covered are locknuts and bushings reproduced from Standard Practice SP-16 and SP-17 of the Manufacturers Standardization Society of the Valve and Fittings Industry. For convenience the dimensions of pipe plugs in accord with the American Standard for Pipe Plugs of Cast Iron, Malleable Iron, or Forged Steel (B16e2-1936) and the dimensions of welded and seamless steel pipe from the American Standard for Wrought-Iron and Wrought-Steel Pipe (B36.10-1939) are included as an appendix.

Under its tentative status the standard formed a basis for specifications issued by the Federal Specifications Board and the U.S. Navy Department. It was also used as a reference for 150-pound malleable screwed fittings in the ASME Boiler Code and the American Standard Code for Pressure Piping. In its new form, with the additions mentioned above, its usefulness will undoubtedly be augmented.

Copies of the revised American Standard for 150-Pound Flat Band Malleable Iron Threaded Fittings (B16c-1939) are now available at 50 cents.

[1] Vice-president and chief engineer, Walworth Company; representative of the Manufacturers Standardization Society of the Valve and Fittings Society on ASA Committee B16.

The National Standards of Measurement[1]

by
Lyman J. Briggs

Director, National Bureau of Standards

The fundamental standards of measurement, upon which depend all those countless measurements which the engineer and chemist must make in controlling the technical processes of industry, are here described in clear, interesting language. Of special interest is the question of the use of the wave length of light rays as a supplementary definition of the inch.

The National Bureau of Standards, of which Dr. Briggs is the responsible head, is charged by law with the maintenance of these fundamental standards to the highest attainable accuracy. Through cooperation with the weights and measures officials of the state governments as well as through direct cooperation with trade and industry, the Bureau is also performing the essential service of translating these fundamental measurements of precision into the working measurements of industry and trade.

—P. G. Agnew

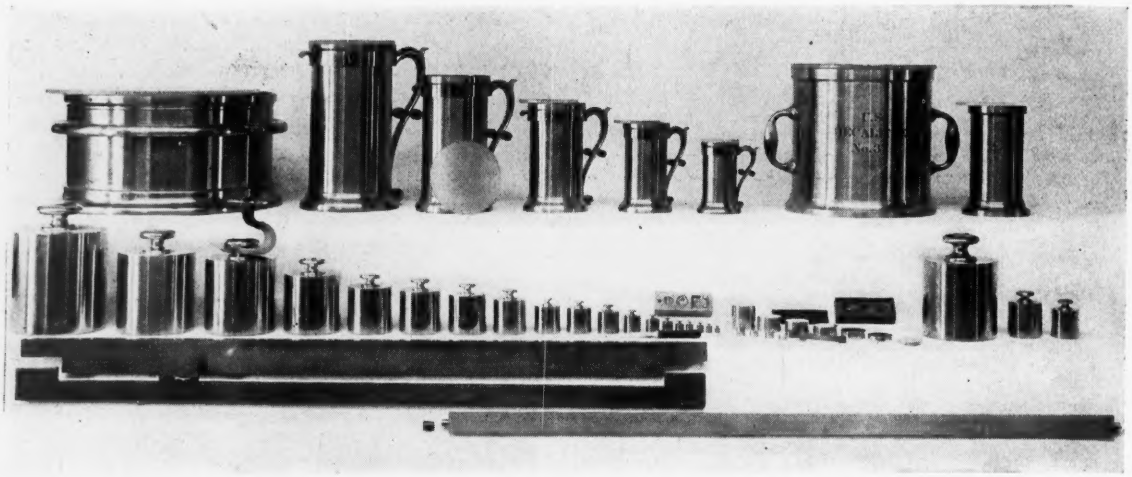
THE difficulties under which commerce had been carried out among the thirteen Colonies, owing to the lack of uniform standards, were probably responsible in part for the provision of the Constitution which delegates to Congress the power "to fix the standard of weights and measures." In the early days of the new Republic, Washington in his presidential messages to Congress repeatedly urged the importance of carrying out this constitutional provision; but for eighty years no formal action was taken by Congress to "fix" the standards, save for the adoption in 1828 of a standard Troy pound for coinage purposes.

Not that the subject was ignored. Repeatedly the matter came up for discussion without definite action. A standard of length which could if necessary be independently reproduced from physical observations repeatedly intrigued the interest of Congress. Jefferson, as Secretary of State, submitted a proposal for a standard of length based upon the length of a uniform cylindrical pendulum beating seconds at sea level at 45 deg N Lat. In 1795 President Washington presented to Congress a communication from the Minister of the French Republic suggesting the adoption by the United States of the metric system of weights and measures. This proposal, however, met with little favor. A standard based on the length of one ten-millionth of the earth's quadrant apparently had less appeal from the standpoint of reproducibility than one based on the length of a pendulum beating seconds.

Meanwhile, various State legislatures were imploring Congress to take some action to bring about uniformity; and in 1821, John Quincy Adams, as Secretary of State, urged Congress "to fix the standard with the partial uniformity of which it is susceptible at present, excluding all innovations. To consult with foreign nations for the future and ultimate establishment of universal and permanent uniformity." Prophetic words! Not yet has the goal been reached.

In 1830 the Treasury Department, which was charged with the collection of customs, was instructed through a resolution of the Senate to investigate the weights and measures in use in the

[1]Address by Dr. Briggs as retiring president of the American Physical Society, at the Society's Washington meeting, December 28, 1938. Reprinted from the "Reviews of Modern Physics" by special permission.



Standards of Length, Mass, and Capacity Furnished to the States

The standards furnished to the States by action of Congress June 14, 1836 (customary standards), and July 27, 1866 (metric standards), comprised: 9 avoirdupois weights (1 to 50 pounds); 24 avoirdupois weights (0.0001 to 8 ounces); troy pound; 27 troy weights (0.0001 to 10 ounces); standard yard; 5 liquid capacity measures (½ pint to 1 gallon); half-bushel measure; line standard meter and end standard meter; liter, decaliter; 10-kilogram weight; ½ kilogram; 1 gram; set of metric weights (4 decigrams to 1 milligram).

various customhouses of the country, with a view to bringing about uniformity in the collection of customs. The Secretary of the Treasury gave a broad interpretation to this authority to "investigate," and the outcome was that the various custom offices were supplied, without further action by Congress, with uniform sets of weights and measures. These included an avoirdupois pound of 7000 grains, and a yard of 36 inches, based upon standards which Hassler, the first Superintendent of the Coast and Geodetic Survey, had secured in England.

So well pleased was Congress with this solution of its difficulties that the Secretary of the Treasury in 1836 was directed through a joint resolution to deliver to the Governor of each State a complete set of all the weights and measures used by the Treasury Department in the collection of customs. Although no Congressional action was taken to legalize these standards, a number of the States adopted them independently, and a groundwork for uniform weights and measures was at last provided.

It was not until after the Civil War that Congress took the first formal step to legalize a system of weights and measures, and this, oddly enough, did not relate to the weights and measures in common use but to the metric system, rejected in 1795. The act of 1866 reads as follows:

"It shall be lawful throughout the United States of America to employ the weights and measures of the metric system; and no contract or dealing or pleading in any court shall be deemed invalid, or liable to objection, because the weights or measures expressed or referred to therein are weights or measures of the metric system."

We have thus the anomalous situation in this country of a legalized system of metric weights and measures which is used for scientific purposes, and a customary system of weights and measures which is in common use but has never been formally legalized. When Congress passed the Metric Act in 1866, it realized that the country had no metric standards and accordingly included the approximate equivalents of the metric system in English measure. The length of the meter was defined in inches, even though the length of the inch had never been "fixed." That Congress had in mind only an approximation to the true ratio of the units in the two systems is evident from the fact that the meter is given as equivalent to 39.37 inches, while the millimeter is rounded off to 0.0394 inch.

The platinum-iridium meter and kilogram, supplied to our Government as a result of its participation in the Metric Convention, provided this country with far better material standards than it had ever had before. Both the meter bar and the kilogram had been carefully compared with the international prototypes, and the coefficient of expansion of the meter bar had been measured. Moreover, they constituted, together with the Troy pound, the only legal material standards possessed

by the Government. Accordingly, in the absence of further Congressional action, Superintendent Mendenhall of the Coast and Geodetic Survey in 1893 issued the following order:

"The Office of Weights and Measures, with the approval of the Secretary of the Treasury, will in the future regard the international prototype meter and kilogram as fundamental standards, and the customary units, the yard and the pound, will be derived therefrom in accordance with the act of July 28, 1866."

It will be recalled that the act of 1866 defines the meter in terms of the inch, and when this is transposed by the Mendenhall order it leads to the incommensurate relation

$$1 \text{ inch} = 0.02540005 + \text{meter.}$$

It is obvious that it is not practicable to lay off this incommensurable decimal fraction on a meter bar, so that this relation defines a theoretical inch rather than one that can be derived with exactness from the meter bar. The inch thus defined is also about four-millionths longer than the British inch, which is determined directly from the Imperial yard.

As a matter of fact the inch now used for engineering purposes both in the United States and Great Britain, and in 13 other countries as well, is based upon the simpler relation, one inch equals 25.4 millimeters[2] exactly. From this simplified relation it is practicable to derive the inch from the meter bar. Furthermore, it is possible to shift from English to metric units on a screw-cutting lathe by the introduction of a gear having 127 teeth. Finally the ratio 25.4 falls midway between the present accepted values of the British and the United States inch. Both countries could adopt this value without disturbing industry in the slightest, because a change of two parts in a million would not be detected in any industrial operation.

To summarize the situation, the United States for 150 years has been using a customary system of weights and measures without "fixing" the standards on which the system is based. A bill was presented to the last Congress with the simple objective of putting the Government's house in order in this respect. The bill provided that the inch and the pound should be fixed in terms of the meter and the kilogram, respectively, by means of specified ratios. The ratio proposed for the inch was

$$1 \text{ inch} = 0.0254 \text{ meter.}$$

The bill also carried a supplementary definition of the inch in terms of light waves. This was based upon the value adopted by the International Committee on Weights and Measures for the number of wave-lengths of the red radiation of cadmium in a meter, a value which, as I shall show later, is well supported by several independent determinations.

Checking Standards of Length

With this comparator the reference standards of length used by industry are compared with the National Standard. The National Standard of Length, Meter No. 27, is shown below with a sample of the material from which the standard was made, giving a cross-sectional view of the X-shaped design of the standard. The standard is made of an alloy of 90 per cent platinum and 10 per cent iridium.

This bill did not come to a vote. Hearings were held by the Committee on Coinage, Weights, and Measures, and the provisions of the bill were found to meet with the general approval of industry. In fact some men directly concerned with precise industrial measurements were inclined to urge that the inch be defined directly in terms of wave-length. It seems desirable, however, to have the inch, like the centimeter, based upon an actual material standard. And it is important that this standard should be common to the two systems of units in order that the ratio of the two units of length may be unequivocally fixed.

Opposition to the bill came from an unexpected quarter. The system of plane coordinates which forms the basis for Federal and State surveys is in terms of English units. Now the primary triangulation surveys of the U.S. Coast and Geodetic Survey are all carried out in the metric system, and in

[2] This simplified relation between the inch and the millimeter was approved as an American Standard for industrial use in 1933 on recommendation of a general conference of industry.—ED.

converting these measurements to plane coordinates in feet, the ratio 1 meter=3937/1200 feet has been used. Those engaged in these mapping operations naturally do not wish to see this procedure changed, and with this viewpoint the National Bureau of Standards is in complete sympathy. An amendment to the original bill has therefore been proposed, authorizing the continued use of the adopted ratio in the conversion of metric geodetic measurements to English units in connection with plane coordinates, elevations, and other map data. This amendment provides full authority to maintain the present procedure in geodetic conversions without sacrificing all the other desirable provisions of the bill. It should be emphasized that the point involved relates only to a computation, the conversion into feet of measurements originally carried out in meters in making primary surveys. A change of two parts in a million in the basic value of the inch would not have any effect whatsoever upon any surveys made directly in feet because such surveys cannot approach this order of accuracy. As a matter of fact, the hundred-foot tapes calibrated by the National Bureau of Standards are certified to only one part in a hundred thousand.

The Primary Standard of Length

The national primary standard of length is represented by the platinum-iridium meter bar No. 27. Its use is limited to comparisons with the working standards. A companion bar, No. 21, of identical form and composition, has borne the brunt of extensive comparisons for more than 40 years, particularly in connection with the certification of geodetic tapes for the Coast and Geodetic Survey. The Bureau also owns two other platinum-iridium meter bars of an earlier alloy, one of which is graduated in millimeters.

The stability of these bars in service reflects the wise judgment of those who were responsible for the selection of the alloy from which the prototypes were made. Meter No. 21, which has been used so much and subjected to the thermal shock of innumerable ice baths, has increased in length about one micron during its 50 years of service. Meter No. 27, the national prototype, has been certified by the International Bureau of Weights and Measures as follows:

In 1888-89

No. 27=1 meter−1.50 microns at 0 C

In 1921-23

No. 27=1 meter−1.48 microns at 0 C

These equations indicate that within the limits of measurement the length of meter bar No. 27 has remained invariable in relation to the International prototype for the period covered. This fact alone does not of course preclude the possibility that both bars are drifting. The conclusion that they are not is supported by other intercomparisons and can be examined in another way. During a period of 40 years, various determinations have been made of the length of the meter in terms of wave-lengths of the red radiation of cadmium. The meter bars used in these measurements were compared with the international prototype at the time they were used. Any change in the length of the international prototype would thus tend to be reflected in the derived value of

Table 1

Wave-length of the red line of cadmium in angstroms[1]

Date	*As Originally Given*	*After (a) Correction and (b) Adjustment to Uniform Conditions*[2]	*Difference from Mean*
1895 Michelson and Benoit	6438.4722	6438.4691	−0.0002
1905-6 Benoit, Fabry and Perot	6438.4696	6438.4703	+0.0010
1927 Watanabe and Imaizumi	6438.4685	6438.4682	−0.0011
1933 Sears and Barrell	6438.4711	6438.4708	+0.0015
1934-35 Sears and Barrell	6438.4709	6438.4709	+0.0016
1933 Kosters and Lampe	6438.4672	6438.4672	−0.0021
1934-35 Kosters and Lampe	6438.4685	6438.4685	−0.0008
	Mean	6438.4693	±0.0012

[1]J. E. Sears, Sci. Prog. 31, 209 (1936).

[2]Note: The values originally quoted by the authors are corrected in the fourth column to take account of subsequent conclusions (*a*) regarding the values to be attributed to the standards of length employed, and adjusted (*b*), so far as the information available permits, to uniform conditions of "normal" air—*i.e.*, dry air at 15 C and 760 mm pressure, containing 0.03 percent CO_2.

the wave-length, in microns, of the red line of cadmium. Table 1 shows no evidence of any systematic drift.

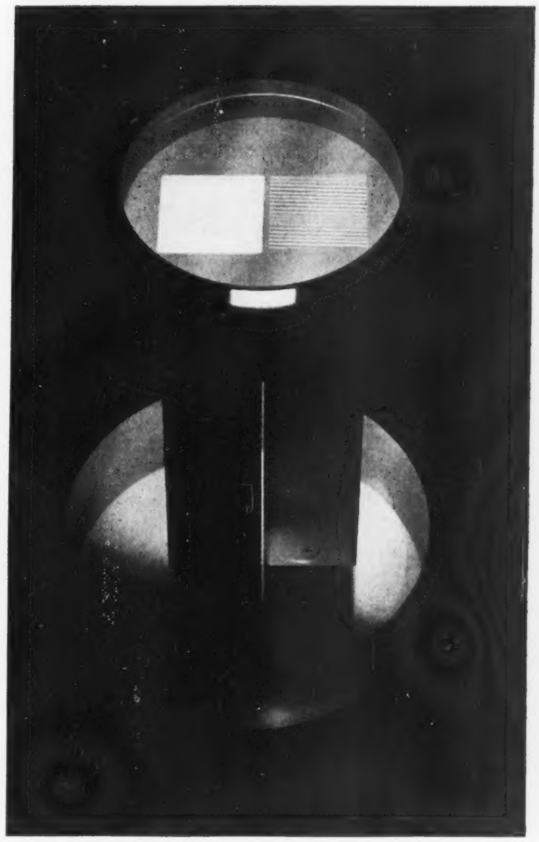
It will be noted that the mean value of the determinations agrees closely with the original value of Benoit, Fabry, and Perot (6438.4696 angstroms), which since 1907 has been used by the International Astronomical Union as the standard to which all spectroscopic wave-length measurements are referred. In view of this fact, the National Bureau of Standards proposed, in the legislative bill referred to above, that the meter and the inch should be given supplemental definitions in terms of wave-lengths of the red radiation of cadmium, in conformance with the relation adopted by the International Astronomical Union. These supplemental definitions, if adopted, will legalize the direct use of interference methods in the precise determination of the length of gage blocks and similar working standards. The practical value of this procedure cannot be too strongly emphasized.

End Standards

In the past few years the close tolerances placed on the mass production of interchangeable parts has led to the extensive use of precision end gages. These are blocks, usually of metal, with two opposite faces accurately plane, parallel, and a specified distance apart and are used to check various measuring instruments. The extent to which these gages are used can be judged by the fact that more than 50,000 have been tested at the National Bureau of Standards. Using interference methods the surfaces of such gages can be tested and the length determined with greater accuracy than by referring to line standards.

In order to provide the Bureau with end standards of the highest precision, C. G. Peters and W. B. Emerson undertook the construction in 1934 of a series of end standards by direct interference methods, based upon the standard wave-length of the red line of cadmium. Fused quartz was chosen for the blanks, because its low expansivity (about 1/30 that of steel) removes the necessity of accurate temperature control, and it can be given a high optical polish free from imperfection.

Fifteen blanks two cm square in cross section and 10 cm long were cut from blocks of optically clear fused quartz. These were annealed by heating to 1150 C and then ground and polished to size. Extended measurements of these gages were carried out during a period of two years, including measurements made by the International Bureau, the National Physical Laboratory, and the Physikalisch-Technische Reichsanstalt. From all of these determinations, no measurable change in dimension has been detected in any of the quartz gages. The end surfaces were plane and parallel within less than 0.02 micron and the maximum difference in various determinations of the length of any one gage did not exceed 0.02 micron, or two parts in 10 million.



Comparison of Quartz and Steel Gages

The two gages are "wrung down" on a quartz flat. A second flat is placed on top of them. Light from the mercury lamp causes the appearance of the interference fringes across the upper ends of the blocks. These show any difference in the lengths of the blocks, and also whether their upper end surfaces are plane and parallel.

In making these standards the decimeter length was chosen because this is about the maximum length for which clear interference rings can be obtained with the sharpest spectral lines. With these lines the number of waves in the path ranges from 300,000 to 400,000. The fractional order can be measured to about 0.01 of a wave-length, so it is possible to attain a precision of one part in 30 to 40 million in the comparison of two wave-lengths; and about one part in 10 million in the direct determination of a material length standard.

Standard Wave-Lengths

The international primary standard of wave-length is the red radiation of cadmium. The wave-

length of this radiation as officially adopted by the International Committee of Weights and Measures is 6438.4696 angstroms under specified standard conditions.

Tribute should be paid to the painstaking studies of Michelson 40 years ago that led him to select the red radiation of cadmium as the standard wave-length to be evaluated in terms of the meter. All of the spectroscopic work which has been done since that time, including the study of the spectra of helium, krypton, neon, and other gases then unavailable to Michelson has failed to disclose another strong line of superior quality. Two krypton lines are the closest rivals for this honor.

Using the cadmium line as a primary standard, the International Astronomical Union has adopted a series of secondary wave-length standards, including 20 neon lines, 20 krypton lines, and about 300 lines in the iron arc. The measurements of Meggers, Kiess, and Humphreys at the National Bureau of Standards have contributed substantially to the establishment of all of these secondary standards. Most of the neon and krypton standards are known relative to cadmium with a precision of two or three parts in a hundred million while the precision of the iron standards is about one order less. These standards provide the framework of all spectroscopic measurements.

The Standard Plane Surface

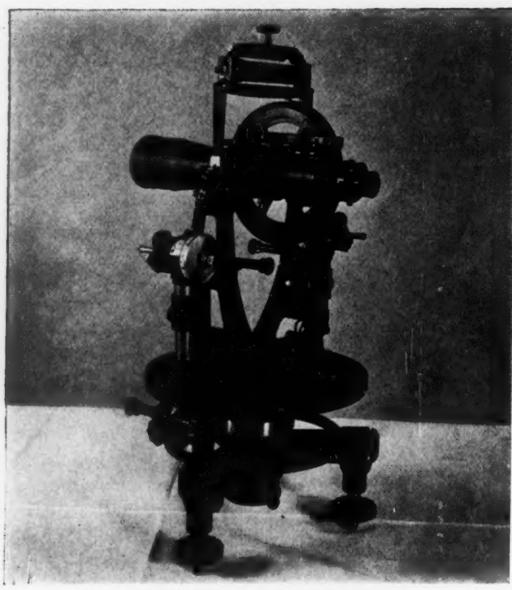
In order to secure a surface which is optically plane to a high degree of precision it is necessary to prepare three surfaces, which when tested in pairs in any of the three possible combinations and in any orientation one to the other show uniformly straight interference fringes. The plane surfaces are actually developed by working these three surfaces one against another in rotation, up to the final stages of polishing.

The standard plane surface of the Bureau is maintained by means of three fused-quartz disks, each 28 cm in diameter and about four cm thick. One surface of each is a true plane within one-hundredth of a fringe. In other words, these surfaces depart less from true planes than they would if they conformed strictly to the curvature of the earth.

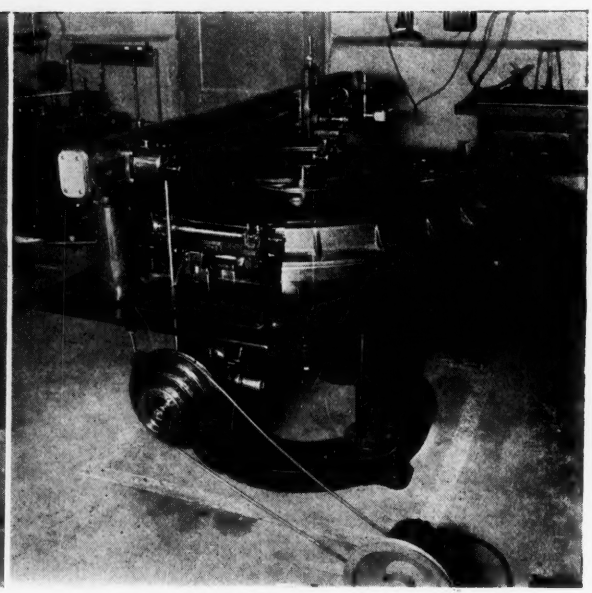
In testing these planes, care must be used to support the disks in such a way as to prevent them from bending under their own weight. The stability of the fused-quartz disks has been most gratifying; no measurable deviation from planeness has taken place in the last 10 years.

Angular Measure

Angular quantities must be measured with great precision in carrying out primary geodetic



Theodolite used by the U.S. Coast and Geodetic Survey for measuring precision angles in geodetic surveys. The horizontal circles for these instruments are graduated at the National Bureau of Standards.



High-precision electrically driven circular dividing engine for dividing circles for theodolites and other high-precision instruments. This high-precision instrument is accurate to ½ second of arc.

surveys. In determining the errors of a completely graduated circle, the Bureau uses a special comparator which is provided with four fixed micrometor microscopes spaced 90 degrees apart around the central rotating table carrying the circle. No standard circle is needed in this case because we are dealing with a closed system. Errors as small as 0.2 second in a nine-inch graduated circle can be measured if the graduation lines are of the highest quality.

The Bureau's circular dividing engine is used mainly for graduating precision theodolite circles for the U.S. Coast and Geodetic Survey. B. L. Page has graduated solid silver circles nine inches in diameter to five minutes of arc with no error throughout the circle as great as two seconds of arc; that is, with no line displaced from its correct position by more than one micron.

The Standard of Mass

The national standard of mass is represented by the cylinder known as the prototype kilogram No. 20. It is made of the same platinum-iridium alloy as that used in the prototype meter bars. This national standard was recently taken to Paris for a new comparison with the international prototype. Its certified mass was 0.99999998 kilogram, a change in mass of only two parts in a hundred million in 50 years. This difference is within the uncertainty of measurement.

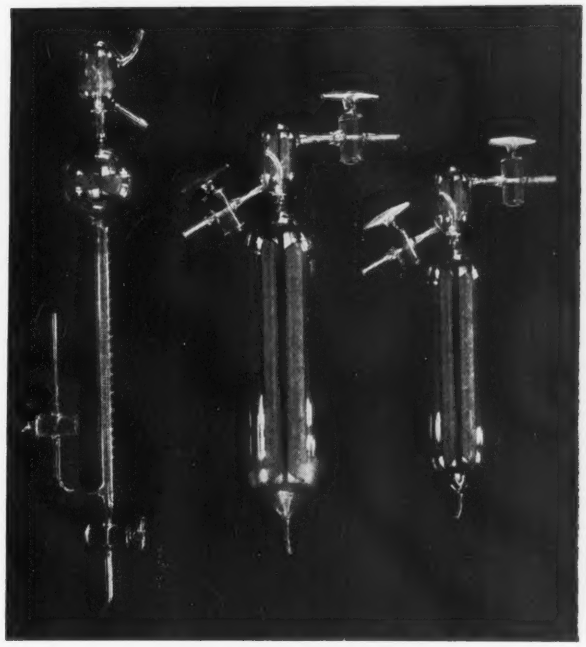
Two other standard kilograms, one of platinum-iridium and one of pure platinum, are used as working standards.

Standard of Capacity

The standard of capacity, the liter, is established by weighing. It is defined as the volume occupied by a kilogram of water at its maximum density. This volume is unfortunately not exactly 1000 cubic centimeters as the founders of the metric system had intended: One milliliter = 1.000027 cc. The discrepancy is within the error of measurement of most volumetric determinations, but in precise density measurements the unit of volume (cubic centimeter or milliliter) must be specified.

The Standard of Frequency

The national standard of frequency is maintained by means of seven quartz oscillators, with natural frequencies of 100 or 200 kc per sec. They are carefully protected from external vibration and the temperature and pressure are closely controlled. These oscillators are intercompared constantly and they are also compared daily with time signals from the Naval Observatory. For this purpose, one of the oscillators, with the aid of a submultiple generator, drives a synchronous motor clock which indicates mean solar time.



Standards of Capacity

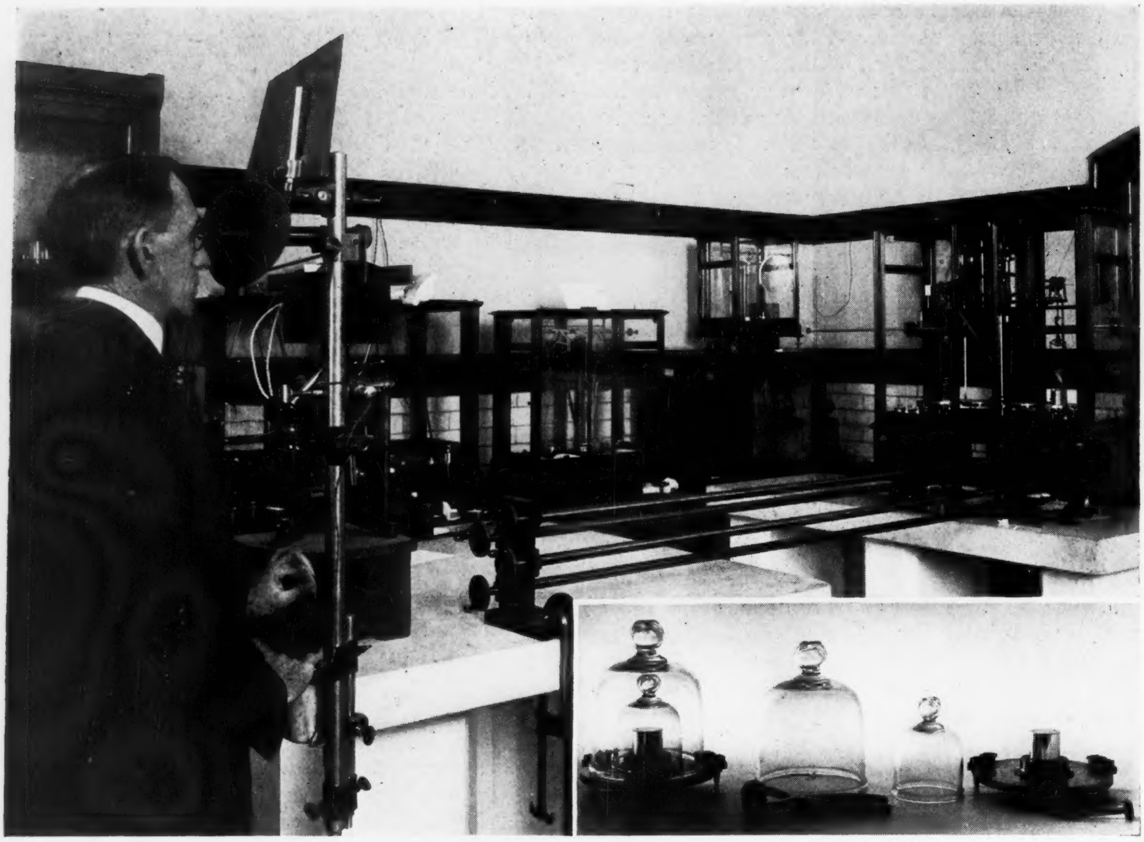
The two flask standards *(right)* were designed and constructed at the Bureau for rapid verification of glass measuring apparatus. They are working standards standardized for precision tests.

This group of oscillators serves to control the precision of the standard frequencies of 5000 kc per sec, 10,000 kc per sec and 15,000 kc per sec which are broadcast several days each week from the Bureau's station WWV at Beltsville, Md. These frequencies do not deviate more than one part in five million from the assigned value.

By means of this service, broadcasting stations throughout the United States are enabled to adhere closely to their assigned frequencies. In addition, the emissions are modulated to give certain standard frequencies in the audible range, which have been found very useful by physicists and engineers. These modulations include a frequency of 1000 c per sec as well as sharp one-second pulses, accurate to 0.00001 second. The broadcasting of the standard of musical pitch, 440 c per sec, representing "A" above middle "C" has also met with wide favor both by musicians and laboratory workers alike.

Electrical Standards

The standard of resistance—Since 1908 the national standard of electrical resistance has been represented by a group of 10 one-ohm manganin



The Standard of Mass

The Mass Section laboratory, showing the high-precision balance which will compare two kilogram weights with an error of less than one part in 100 million.

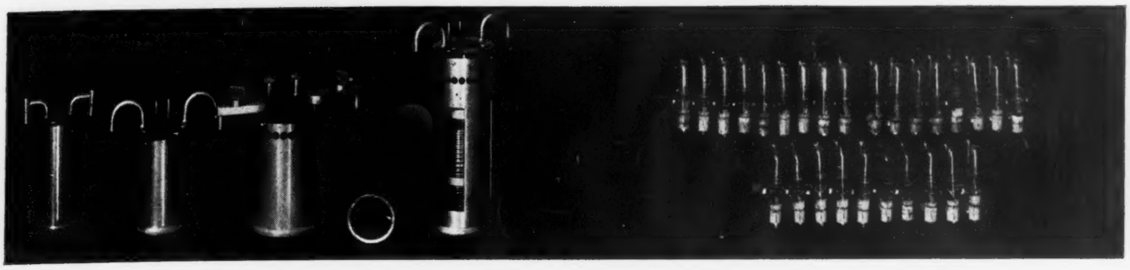
The National Standard of Mass, Kilogram No. 20, is shown in the insert with double bell jars removed. It is a cylinder 39 mm in diameter and 39 mm high, made of an alloy of 90 per cent platinum and 10 per cent iridium. Kilogram No. 4, a secondary standard and a duplicate of No. 20, is shown with the bell jars in place. Both standards rest directly on quartz plates. They were furnished by the International Bureau of Weights and Measures in pursuance of the metric treaty of 1875. The chamois-faced lifting forceps with which the standards are handled appear in front of the outer bell for Kilogram No. 20.

coils, the average value of which has been assumed to remain constant. The value originally assigned to each coil was based upon standards certified by the Physikalisch-Technische Reichsanstalt in 1908. When any member of the basic group of 10 coils showed a pronounced tendency to drift in relation to the group, it was replaced by a coil from the reserve group. The NBS "international unit" of resistance is derived from the mean of the values of the resistance of this primary group.

The present evidence is that the mean value of this group has drifted at the rate of about one part per million per year since the group was established in 1908. With the hope of eliminating this drift in resistance standards, J. L. Thomas undertook the development of a new precision one-ohm coil at the National Bureau of Standards in 1928.[3] The manganin resistance after winding was annealed in vacuum at a red heat (550 C) to remove all locked-up stresses, and special precautions were taken to avoid straining the coil afterward while assembling it in its double-walled annular container. These coils have shown remarkable stability, at least relative to one another. The relative changes within the group have been of the order of one part in a million in the past five years, compared with similar changes of the order of 10 parts per million in the coils of the older group. In 1932 the 10 coils of the standard group were replaced by coils of the new type.

The standard of electromotive force—The

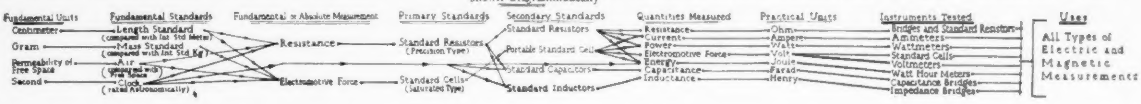
[3] J.L. Thomas, Nat Bur Stds J Research 5, 295 (1930) (RP201).



STANDARD RESISTORS — PRIMARY ELECTRICAL STANDARDS — STANDARD CELLS

Serving in the Comparisons of the Units of Resistance and Units of Electromotive Force used in Various Countries and in the Maintenance of these Units for this Country Between Adjustments of Units by International Agreement
Last Adjustment 1910 – Date set for next Adjustment 1940

Role of Primary Electrical Standards in Tie Between the Fundamental Units and Standards of the Electromagnetic System of Units and Electrical Quantities Measured Electrical Instruments Tested and Their Uses
Shown Diagrammatically



Standard Resistors — ***Standard Cells***

national standard of electromotive force was maintained up to 1937 by a group of twenty saturated Weston cells, with many others in reserve. At that time nine acid cells which had shown gratifying stability were added, and three cells were discarded. The present primary group of 26 cells contains 17 cells that have remained honored members of the group since it was established in 1906. These cells are kept at a constant temperature. The NBS "international unit" of electromotive force is derived from the mean value of the 26 cells of the primary group.

Decision to define the electrical standards in absolute units—At the conclusion of the work of the Washington conference of 1910 the standards of resistance and electromotive force of the United States, England, France, Germany, Japan, and Russia had been brought into good agreement. But subsequent comparisons showed that the standards were slowly drifting apart, and by 1930 differences as large as one part in ten thousand were found in the standards of electromotive force of the different nations, while similar but smaller changes had taken place in the standards of electrical resistance.

A discrepancy also exists between the "international" electrical units now in force and the mechanical units. For example, if the same amount of power were measured first in terms of the electrical units now in use and then in terms of the mechanical units, the difference would amount to approximately one part in five thousand owing to the discrepancy of the units.

For these reasons the International Committee on Weights and Measures decided to replace the present international electrical units with absolute electrical units, the new system to go into effect January 1, 1940.

In order to carry out the wishes of the International Committee it has been necessary for the National Bureau of Standards and the national laboratories of other countries to determine in absolute measure the value of their electrical standards of resistance and electromotive force with the highest attainable precision. A brief description of the Bureau's contribution to this program, which has extended over a number of years, will now be given.

Inductance and current are the most suitable quantities for evaluation in absolute measure because they can be determined to a high degree of precision without involving the measurement of any additional electrical quantity. But the final objective in absolute measurements is the value of the standard of resistance and the standard of electromotive force. The procedure is as follows: (1) The inductance of a coil is computed from its geometrical dimensions and the permeability of the material on which it is wound; (2) this known inductance, when measured experimentally in terms of time and a standard resistor, serves to fix the value of the resistor in absolute measure; (3) current is determined in absolute value from the geometrical dimensions and positions of the coils of a current balance, supplemented by the absolute measurement of the force exerted between the coils; (4) the potential drop across the standard resistor when connected in series with the current balance serves to fix the value of a standard cell in absolute measure.

The absolute measurement of electrical resistance—Two independent groups at the National Bureau of Standards have been working on the absolute measurement of electrical resistance. Curtis, Moon, and Sparks have used an improved self-inductor with an intermediary capacitance in

determining the absolute value of the ohm, while Wenner, Thomas, Cooter, and Kotter have determined resistance in absolute measure by a method using commutative direct current in a mutual inductor.

Self-inductor method with intermediate capacitance[4]—In this method the self-inductance of an inductor is measured in terms of time and a laboratory standard of resistance. The ratio of the computed to the observed inductance provides the correction factor which is to be applied to the resistance standard to give the resistance in absolute measure. The four inductors used in this investigation were of different dimensions and were wound on nonmagnetic forms of different materials; namely, porcelain, Pyrex glass, and fused quartz. The most recent form consists of a heavy-walled glass cylinder 120 cm long and 35 cm in diameter, on the surface of which a very accurate screw-thread was ground and lapped to insure uniformity in the pitch of the helix. The electrical measurements required the use of an intermediary capacitance, so that a resistance was first measured in terms of inductance and capacitance by an alternating-current bridge; then the capacitance was measured in terms of resistance and time by the charge-and-discharge method with a Maxwell bridge. Assuming the capacitance to remain the same under these conditions, it is eliminated between the two bridge equations. Time signals from the U.S. Naval Observatory were used to calibrate a piezoelectric oscillator which controlled the 100 c per sec generator.

The most recent work by Curtis, Moon and Sparks gives the value

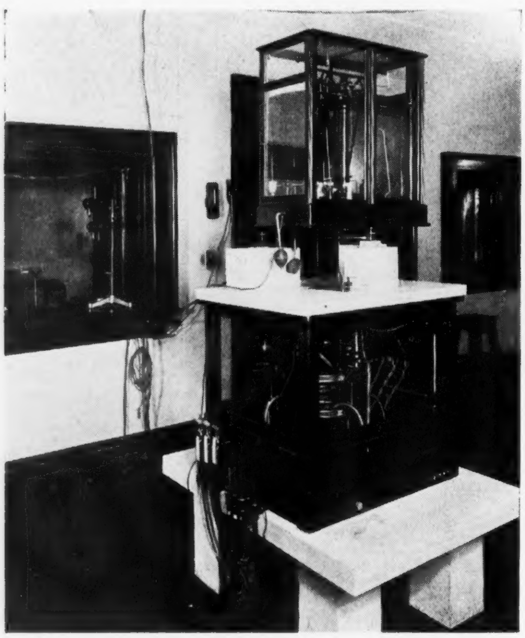
1 NBS international ohm

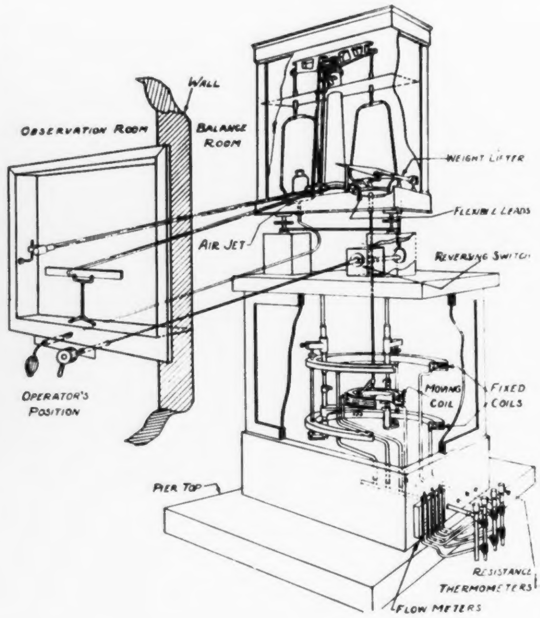
= 1.000483 absolute ohms

which the authors believe to differ from the true value by less than 20 parts in a million.

Mutual-inductor method using commutated current—This method was devised by Dr. Frank Wenner. A direct current is passed through the resistor, and through the primary winding of the mutual inductor. The current through the primary of the mutual inductor is reversed at regular intervals without changing the current through the

[4]H.L. Curtis, C. Moon and C.M. Sparks, Nat Bur Stds J Research 16, 1 (1936) (RP857).



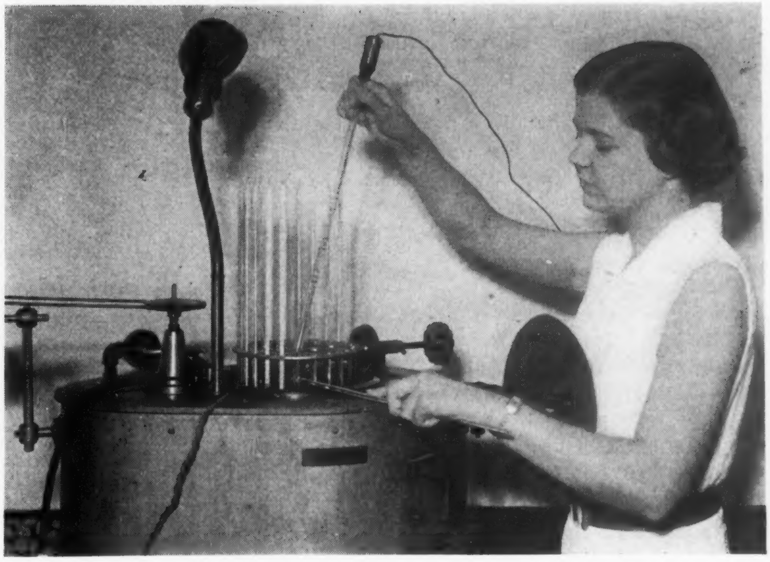


Current Balance Used in the Determination of the Absolute Ampere

The window between the two rooms was closed when observations were being made. Every part of the entire assembly, including the rubber hose for making the water connections, the brass water pipes, and the resistance thermometers in the pipes, was carefully tested and found to be non-magnetic. The only exceptions were the three steel knife edges of the balance, which were more than a meter from the coils. The force to be measured, which is proportional to the value of the current, was only 10 g while the total weight of the coil was over a kilogram. Hence to attain an accuracy of a part in a million in the value of the current, the balance must be capable of making a weighing with an accuracy of a part in a hundred million.

Testing Thermometers

The mercury-in-glass thermometers which have been sent to the Bureau for test have been placed in a water bath, the temperature of which is electrically controlled. The operator is placing a platinum - resistance thermometer, the working standard of the laboratory, in the bath, so that the readings of the mercury thermometers can be compared with the true temperature of the bath as shown by the platinum resistance thermometers.



resistor. Another commutator reverses the connections to the secondary of the mutual inductor in such a way that the pulses of induced electromotive force are always in the same direction. This rectified electromotive force is balanced against the constant potential drop through the resistor. A direct-current galvanometer is used to indicate the balance.

The commutators which control the connections in the primary and secondary circuits are mounted on the same rotating shaft along with an inductor generator and a current-reversing generator. Consequently these units all operate strictly in synchronism.

Without attempting to discuss the circuits in detail, it may be said that if the current in the secondary of the mutual inductor is zero at the time the connections are reversed, and if the average value of the current through the galvanometer is zero, then the resistance in absolute measure is four times the product of the speed and the mutual inductance. The precision of the method is limited theoretically only by the precision with which the speed of rotation of the shaft and the geometrical dimensions of the mutual inductor can be measured.

The shaft is driven by a direct-current motor, automatically synchronized by a current of 1000 cycles per second; this latter frequency is controlled by the primary quartz frequency standards in the Bureau's radio laboratory. Over periods of an hour or more the frequency of the control current is constant and known to one part in 10,000,000, while the speed of rotation, averaged in the way in which it affects a deflection of the galvanometer, is uniform within a few parts in 1,000,000.

The absolute determination of the ohm by Wenner, Thomas, Cooter, and Kotter gives the relation

1 NBS international ohm
=1.000485 absolute ohms

The absolute determination of the ampere —H. L. Curtis and R. W. Curtis[5] have made a new determination of the ampere in absolute measure, employing with some modifications the current balance originally used by Rosa, Dorsey and Miller for this purpose in 1911. The most important modification was the use of coils in which the current distribution closely approached that assumed in the theoretical derivation of the force. The value in absolute amperes of the current in the coils of the balance was computed from the dimensions and positions of the coils, the permeability of the material and the electromagnetic force between the coils, the latter being measured in local gravitational units.

In such measurements, we must know the absolute value of the local acceleration of gravity, and Heyl and Cook[6] have recently completed this determination at the National Bureau of Standards using pendulums of fused silica. They found, at the Bureau station:

$$g=980.08 \text{ cm sec}^{-2},$$

which indicates that the absolute value of gravity at Potsdam, heretofore generally accepted, is about two parts in 100,000 too large.

The current through the balance coils was measured simultaneously (1) in absolute value by means of the balance and (2) in "international"

[5]H.L. Curtis and R.W. Curtis, Nat Bur Stds J Research 12, 665 (1934) (RP685).

[6]P.R. Heyl and G.S. Cook, Nat Bur Stds J Research 17, 805 (1936) (RP946).

amperes as determined by the potential drop across a standard resistor in series with the balance coils.

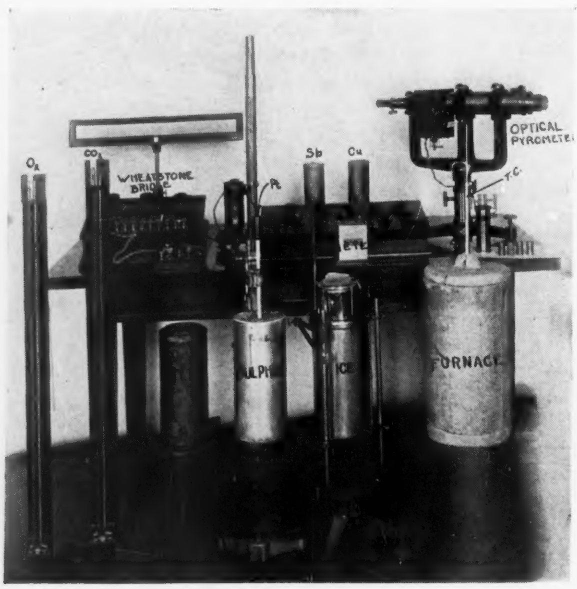
The result of the most recent measurements with balance coils of improved design is:

1 NBS international ampere
=0.999852 ampere (absolute).

The International Temperature Scale

The thermodynamic scale of temperature introduced by Lord Kelvin has long been accepted by physicists as the ideal temperature scale. However, the experimental difficulties incident to the practical realization of the thermodynamic scale by means of the gas thermometer and the consequent discrepancies that arose in the temperature scales used by different nations led the national laboratories of Germany, Great Britain, and the United States in 1911 to undertake the unification of their temperature scales. This culminated a quarter of a century later in the adoption by the International Committee of Weights and Measures of the International Temperature Scale.[7]

This scale conformed with the thermodynamic scale as closely as knowledge permitted at the time, and was designed to be definite, conveniently and accurately reproducible, and to provide means for uniquely determining any temperature within the range of the scale. It is based upon six fixed and reproducible equilibrium temperatures to which numerical values are assigned; namely, the oxygen point (−183 C), the ice point (0 C), the steam point (100 deg), the sulphur point (444 deg), the silver point (960.5 deg) and the gold point (1063 deg). Intermediate temperatures are determined by means of interpolation instruments calibrated according to a specified procedure at the fixed temperatures.



Apparatus for reproducing the standard temperature scale

From the oxygen point to 660 C the temperature t is deduced from the resistance of standard platinum resistance-thermometers; from 660 C to the gold point, by means of a standard platinum *vs* platinum-rhodium thermocouple; and above the gold point, from Wien's law by means of the intensity of blackbody radiation, measured by an optical pyrometer.

The International Temperature Scale was adopted with the understanding that it was susceptible to revision and amendment. The first meeting for the consideration of possible revisions will be called in Paris in June, 1939.

There is great need for the official extension of the scale from the oxygen point down to the triple point of normal hydrogen (−260 C). At present the National Bureau of Standards maintains the scale in this region by means of a group of well-seasoned resistance thermometers. Hoge and Brickwedde[8] have shown the feasibility of establishing a number of fixed points in this part of the scale, represented by the equilibrium states of coexisting phases of pure substances. With these points once established, resistance thermometers need be used only for interpolation.

Another matter that requires consideration is the value of c_2 in the radiation equation. The value now specified in defining the International Scale is c_2=1.432 cm degrees. More recent determinations indicate that this value should be increased to 1.436 cm degrees. This would decrease the present value of the platinum point by about 3 C.

Radiation Standards

The international roentgen—The international roentgen is the quantity of X-rays that will liberate one electrostatic unit of charge from one cm^3 of air by ionization under specified standard conditions. It is realized at the National Bureau of Standards by means of a standard ionization chamber developed by Taylor and Singer[9] which has now been adopted as the ionization standard of six other countries besides our own. The calibration of X-ray dosage meters in roentgens is carried out by means of this standard chamber.

Radium standards—Radium is certified by the National Bureau of Standards in terms of the

[7] G.K. Burgess, Nat Bur Stds J Research 1, 635 (1928) (RP22).

[8] H.J. Hoge and F.G. Brickwedde, Nat Bur Stds J Research 22, 351 (1939) (RP1188).

[9] L.S. Taylor and G. Singer, Nat Bur Stds J Research 5, 507 (1930) (RP211).

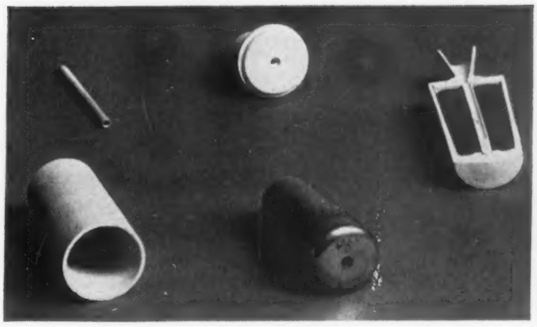
weight of radium element, but the measurement which is actually made is the determination of the ratio of the gamma-ray intensity of the specimen to that of a radium standard. The Bureau has three primary radium standards carrying certificates from the International Radium Commission. The first of these (International value 15.44 mg) was prepared by Madame Curie (1913) and the other two (International values 38.10 mg and 20.36) by Honigschmid (1936) from radium chloride of high purity. The Curie standard when corrected for decay is in accord within 0.1 percent with the values assigned by Honigschmid to the standards he prepared. Radium standards must be systematically corrected for decay. The initial rate of decay is about 0.043 percent per year.

Standards of radiant flux—The National Bureau of Standards maintains standards of radiant flux, based upon absolute measurements by Coblentz.[10] Lamps are now supplied by the Bureau with certificates giving the total radiation in microwatts per square centimeter at a specified distance from the source.

The standard of brightness—International agreement has now been reached regarding the adoption of a primary standard of brightness, defined as the intensity of the radiation from the interior of a blackbody at the temperature of pure platinum at its freezing point. This standard was originally proposed by Waidner and Burgess in 1910 but was first actually realized at the National Bureau of Standards in 1931 by Wensel, Roeser, Barbrow, and Caldwell,[11] following the development of the thoria crucible.

Using the same device operated at the freezing points of rhodium and iridium in addition to platinum, Wensel, Judd, and Roeser[12] established an accurately reproducible scale of color temperature. This scale is made available to the public through the distribution of color-temperature standards in the form of tungsten-filament lamps.

Comparison of the blackbody standard with the present international candle as maintained by groups of carbon-filament lamps showed that the brightness of the new standard was about 58.9 international candles per square centimeter. However, a uniform procedure has not been followed internationally in the step-up from the yellower sources to the modern tungsten lamps, and E. C. Crittenden found that a better agreement with present practice would be reached by defining the brightness of the standard blackbody radiator as equal to 60 candles per square centimeter. Other national laboratories have agreed to the Bureau's suggestion to adopt this value, and this recommendation has been approved by the International Committee of Weights and Measures. In stepping up from the blackbody standard to tungsten lamps, it is proposed to use the luminosity factors recommended by Gibson and Tyndall[13] of the Bureau staff in 1923, and later adopted by both the International Commission on Illumination and the International Committee of Weights and Measures. At last we have an international primary standard of brightness.



The component parts of the Waidner-Burgess standard of light

[10] W.W. Coblentz and R. Stair, Nat Bur Stds J Research 11, 79 (1933) (RP578).

[11] H.T. Wensel, W.F. Roeser, L.E. Barbrow, and F.R. Caldwell, Nat Bur Stds J Research 6, 1103 (1931) (RP325).

[12] H.T. Wensel, D.B. Judd, and W.F. Roeser, Nat Bur Stds J Research 12, 527 (1934) (RP677).

[13] K.S. Gibson and E.P.T. Tyndall, Sci Pap Bur Stds 19, 131 (1923) (S475).

National Bureau of Standards Describes Certification Plan

A letter circular describing the certification plan of the National Bureau of Standards is now available. The circular, designated as Letter Circular LC559 and dated July 6, 1939, is entitled, "The Certification Plan, Its Significance, Scope, and Application to Selected Federal Specifications and Commercial Standards." The Certification Plan consists in the preparation of lists of "willing-to-certify sources of supply." These are lists of manufacturers who have expressed their desire to supply material on contracts based on certain selected Federal Specifications and Commercial Standards, and their willingness to certify to the purchaser, upon request, at the time of placing the contract, that the material thus supplied is guaranteed to comply with the requirements and tests of the specifications.

First Canadian Consumer Standard Sets Rules for Labeling Hosiery

The first standards for consumer goods authorized by the recent amendment to the Dominion Trade and Industry Commission Act were set up by the Commission this month when it issued rules for the marking of hosiery, it was announced by Trade Minister W. D. Euler July 27.

The regulations, which were requested by the industry itself, resulted from conferences attended by the Canadian Woollen and Knit Goods Manufacturers Association, experts from the National Research Council, and the commission itself. Marking of hosiery is not compulsory but if any marking is placed on hosiery it must be in accord with these rules.

The rules provide that when a combination of two or more textile fibers is used, all must be indicated, providing they each amount to more than five per cent. Descriptive terms such as botany, lisle, mercerized, crepe, chiffon, must be used only in combination with the description of the fiber; for example, botany wool, lisle cotton, mercerized cotton, rayon crepe, silk chiffon. Trade names or brands may not suggest a fiber content except in combination with the word or words authorized for describing the actual fiber content.

The regulations become effective February 1, 1940, as far as manufacturers and importers are concerned, and on February 1, 1941, as far as jobbers, wholesalers, and retailers are concerned.

Textile manufacturers are already trying to work out among themselves the basis for similar standards in fabrics, it was announced. As experience is gained from the application of this first set of regulations, the commission is expected gradually to extend the application of standards to many commodities.

Management Society Schedules Standardization Session

"Standardization and the Evolution of Management" will be the theme of the standardization section of the Annual Conference of the Society for the Advancement of Management October 5-7, 1939. Richard H. Lansburgh, director of the Pennsylvania Economy League of Philadelphia, will act as chairman of the Standardization Session.

The principal speaker at the session will be John Gaillard, Mechanical Engineer of the American Standards Association, who will state the theme of the session, comparing the functions of standardization in industrial management to the cerebellum in the human brain. "Evolved in the course of ages as a distinct portion of our brain, the cerebellum automatically controls and coordinates numerous functions, saving our energy for conscious actions," the program of the session explains. "In Tomorrow's organization, standardization, acting as the cerebellum of management, will facilitate executive planning and help to create an harmonious scheme of cooperation."

The discussion of the theme talk will be opened by men interested in four different phases of standardization work:

Harold B. Bergen, Counselor on Industrial Relations and Personnel Management, McKinsey, Wellington & Company, New York (Standardization in Personnel Management)

Albert Pleydell, First Deputy Commissioner, Department of Purchase, City of New York (Standardization in Purchasing)

Cyril Ainsworth, Assistant Secretary, American Standards Association (Standardization in Safety Work)

Frank M. Surface, Director of Sales Research, Standard Oil Company of New Jersey (Standardization in Sales)

The session on Standardization will be held at 2:30 Thursday, October 5, at the Pennsylvania Hotel, New York.

Suggests Study of Safety Glass To Change Minimum Standards

A study should be made to determine whether minimum standards for safety glass should specify the use of safety plate glass in place of safety sheet glass in all windows of a car as well as in the windshield, said Dr. Andrew H. Ryan of Chicago at a demonstration in Toledo August 12. The demonstration was held by the Fisher Body division of the General Motors Corporation at the Libbey-Owens-Ford plant.

Dr. Ryan said that tests of safety sheet glass in side windows, using samples considerably better than the minimum requirements approved by the American Standards Association, showed that "it is the unavoidable assumption" that the use of safety sheet glass is a "factor of importance in the causation of accidents."

List of Simplified Practice Recommendations Available

A list of Simplified Practice Recommendations, revised to July 1, is now available from the Division of Simplified Practice, National Bureau of Standards. The list is known as Letter Circular LC-561, and supersedes LC-345.

Quality Control and Office Equipment Standards To Be Discussed at ASA Company Member Forum

QUALITY control and standardization of office supplies and equipment will be the two main subjects at the next meeting of the ASA Company Member Forum to be held in October.

The discussion on the first subject, formally entitled "The Application of Methods of Statistical Analysis to Company Standardization Work," will be opened by Dr. Walter A. Shewhart of the Bell Telephone Laboratories. Dr. Shewhart will outline the theoretical background and the potential contributions of the statistical method. His talk will be followed by a general discussion by those present of the practical application of the statistical method to quality control in different branches of industry.

The discussion on "Standardization of Office Supplies and Equipment" will be presented by E. B. Gage of the Western Electric Company, and will also be followed by general discussion.

The ASA Company Member Forum was organized as a round-table discussion group a few years ago when the suggestion was made to the ASA that it would be advantageous for standardization engineers of ASA Company Members to discuss informally standardization problems.

Latvian Standardizing Body Is New ISA Member

The national standardizing body in Latvia became a member of the International Standards Association July 1. The complete name of the new ISA member is the Institute for Economic Rationalization of the Ministry of Finance. It is located in Riga, the capital of Latvia. The Latvian national standardization organization is the twenty-second to join the ISA, the other members being the national organizations in Argentina, Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Great Britain, Greece, Holland, Hungary, Italy, Japan, Norway, Poland, Rumania, Spain, Sweden, Switzerland, United States of America, USSR.

The American Standards Association represents American industry in the International Standards Association.

City Trains Men in Survey Work For Standardizing Printed Forms

Men trained in the survey work needed as a basis for the standardization of printed forms are available through the City of New York, Standardization of City Forms Department.

The work of these men, many of whom are now available for other jobs, was described in an article "City Finds Substantial Savings When Printed Forms Are Standard" by Albert Pleydell, Deputy Commissioner of the Department of Purchase, City of New York, in the July issue of Industrial Standardization.

Inquiries should be addressed to Richard Moodie, Supervisor, Standardization of City Forms, Municipal Building, New York.

FTC Charges Good Housekeeping With Labeling Without Tests

Claiming that *Good Housekeeping* magazine has been guaranteeing products advertised in the publication which have not been tested by that organization, the Federal Trade Commission on August 17 filed a complaint against Hearst Magazines, Inc.

Among other charges, the complaint states that different labels, all of which are not issued on the basis of scientific tests, are used in the magazine and are authorized for use on advertised products. The similarity of the wording and the use of the name *Good Housekeeping* in all these seals and symbols tends to confuse consumers and mislead them into the belief that all products bearing the seals have been scientifically tested and are guaranteed by *Good Housekeeping* magazine, the Commission says.

The charges contained in the Commission's complaint are "untrue and have no basis in fact," said Richard E. Berlin, executive vice-president of Hearst Magazines, Inc., in a widelv circulated reply. The magazine will defend itself in the hearing and later, Mr. Berlin said, it may be necessary to continue action in the courts. "In either event," he said, "*Good Housekeeping* gladly accepts this opportunity to defend advertising and business in general and to bring the whole matter into the open."

The hearing has been scheduled for September 22.

New British Standards Received by ASA

New standards received recently from the British Standards Institution include standards for electrical wiring and equipment, tools, safety glass, iron and steel, standard methods of test, and a variety of others. Copies may be ordered or borrowed from the American Standards Association. When ordering a standard please refer to it by number as well as by title. The most recent new British Standards are:

Toluoles (Pure toluoles, pure toluole for nitration, 90's toluole, 95's toluole) 805-1939
Transformers for use with electrically operated toys 831-1939
Bell transformers (excluding transformers for use in mines) 832-1939
Radio-interference suppression for automobiles and stationary internal-combustion engines (limits and methods of suppression) 833-1939
Precast concrete blocks for wall 834-1939
Asbestos cement flue pipes and fittings (heavy quality) for domestic heating stoves 835-1939
Whale oil 836-1939
Steel-cored copper conductors for overhead transmission purposes 837-1939
Method of test for the toxicity of wood preservatives to fungi 838-1939
Veterinary cod liver oil 839-1939
Light-gauge seamless copper and copper-alloy conduit and fittings for electrical wiring 840-1939
Lamps-caps and lampholders for architectural lamps for voltages not exceeding 250 volts 841-1939
Voltage-operated earth-leakage circuit-breakers for use on consumers' premises 842-1939
Thermostatically-controlled thermal-storage electric water-heaters with copper containers from 1½ to 100 gallons capacity
Testing of vegetable adhesives 844-1939
Code for commercial acceptance tests for steam boilers 845-1939
Burettes and bulb burettes 846-1939
Cold-rolled mild steel strip for general engineering purposes 847-1939
Testing of fans for general purposes (excluding mine fans) 848-1939
Specification and code of practice for plain sheet zinc roofing 849-1939
Definition of cinematograph "safety" film 850-1939
Chemically prepared oxides and hydrated oxides of iron (marigold, maroon and yellow) pure and reduced 851-1939
Toolmakers' straightedges 852-1939
Welded steel boilers for steam central heating 854-1939
Welded steel boilers for hot water central heating and hot water supply 855-1939
Wing nuts 856-1939
Safety glass for land transport 857-1939
"Best Yorkshire" wrought iron 858-1939
Fuel fired furnaces for heating and heat treatment purposes 859-1939

Revised British Standards also received recently are:

Wrought-iron for general engineering purposes 51-1939 (supersedes 51-1929)
Electric fuses up to 800 amperes and 250 volts to earth 88-1939 (supersedes 88-1937)
Benzoles 135-1939 (supersedes 135-1921)
Electrical performance of industrial electric motors and generators with class a insulation 170-1939 (supersedes 170-1926)
Distribution boards (up to 100 amperes per outgoing circuit and 250 volts to earth) 214-1939 (supersedes 214-1929)
Xyloles 458-1939 (superseding 458-1932)
Coal tar naphthas 479-1939 (supersedes 479-1933)
Fusion welded steel air receivers 487-1939 (supersedes 487-1937)
Nomenclature, definitions and symbols for welding and cutting 499-1939 (supersedes 499-1933)
Pump tests 599-1939 (supersedes 599-1935)
Lead pipes for other than chemical purposes 602-1939 (supersedes 602-1935)
Apparatus for the determination of water by distillation with an immiscible liquid 756-1939 (supersedes 756-1937)
Limits of radio interference 800-1939 (supersedes 800-1937)

Department of Agriculture to Revise Standards for Canned Vegetables

Suggestions for revising the standards for grades of canned fruits and vegetables used by the official grading service of the U.S. Department of Agriculture are being requested by the Department, which announces that the standards are to be revised during the next few months. The revised grades will form the basis of the official grading and certification service of the Department.

"Public warehousemen and bankers are making increased use of the grading service in order that they may secure information from an unbiased source relative to the actual grade of samples drawn from specific lots of merchandise on which they are asked to make loans," says Paul M. Williams, Senior Marketing Specialist, in his request for suggestions for the new standards. "Consumer organizations such as private institutions and state governments are using the grades more and more in their specifications as a basis upon which to procure their subsistence supplies."

The request for suggestions was sent to canners, brokers, wholesale grocers, consumers, bankers, and public warehousemen.

Investigation Justifies Aluminum Restriction In Alloys Standard

An investigation sponsored by the Non-Ferrous Ingot Metal Institute and carried out at the National Bureau of Standards shows that the present restriction of the aluminum content to 0.005 per cent of aluminum in ASTM Specification B 30-36 for Copper-Base Alloys in Ingot Form for Sand Castings is justified, according to a report in the *Technical News Bulletin*, June. Antimony up to 0.25 per cent (the maximum now permitted in that specification) does not have a deleterious effect on the alloy, the report indicates.

The investigation was carried out by H. B. Gardner and C. M. Saeger, Jr., the major purpose being collection of data to be used in the simplification of the present number of compositions.

ASA Standards Activities

Each month this space will be assigned to the listing of new projects, new standards, drafts of standards submitted to the American Standards Association for approval, or drafts not yet submitted but which are now being considered by ASA committees.

Standards Approved Since Publication of Last List of Standards, February 1

(Where price is not shown, copies of standards were not available at time of publication of this issue. Orders will be received by the ASA and filled when copies become available.)

American Standard Safety Code for Mechanical Refrigeration (Revision of B9-1933) B9-1939 20¢

American Standard Specifications for Welded Wrought-Iron Pipe (Revision of B36.2-1934) B36.2-1939 25¢

American Standard Specifications for Electric Fusion-Welded Steel Pipe for High-Temperature Service B36.11-1939 25¢

American Standard Wrought-Iron and Wrought-Steel Pipe (Revision of B36.10-1935) B36.10-1939 50¢

American Standard Indicating Pressure and Vacuum Gages B40.1-1939 40¢

American Standard Manufacturing Standards Applying to Broadcast Receivers (Revision of C16d-1932) C16.3-1939

American Standard Vacuum Tube Base and Socket Dimensions (Revision of C16c-1932) C16.2-1939

American Standard for Malleable Iron Screwed Fittings (Revision of B16c-1927) B16c-1939 50¢

American Standard Methods of Test for Insulation Resistance of Electrical Insulating Materials (Revision of C59.3-1935) C59.3-1939 25¢

American Standard Specifications for Rubber Insulating Tape (Revision of C59.6-1938) C59.6-1939 25¢

American Standard Inspection Requirements for Motor Vehicles D7-1939 25¢

American Standard Safety Rules for the Operation of Electric Equipment and Lines (Revision of Part 4 of C2-1927) C2.4-1939 10¢

American Recommended Practice Manual of Accident Prevention in Construction (Revision of A10-1934) A10.1-1939

American Standard Regulations for the Installation of Air Conditioning, Warm Air Heating, Air Cooling, and Ventilating Systems (Revision of Z33.2-1938) Z33.2-1939

Standards Now Being Considered by Standards Council for ASA Approval

Specifications for Red Lead (Revision of ASTM D 83-31; ASA K24-1937)

Specifications for Commercial Para Red (Revision of ASTM D 264-28; ASA K31-1937)

Specifications for Titanium Dioxide Pigments (ASTM D 476—Withdrawal of Specifications for Titanium Barium Pigment ASTM D 382-35, ASA K38-1937; Titanium Calcium Pigment ASTM D 383-35, ASA K39-1937; Titanium Dioxide ASTM D 384-36, ASA K40-1937)

Specifications for Uncoated Wrought-Iron Sheets (Revision of ASTM A 162-36; ASA C23-1937)

Specifications for Gypsum Plasters (Revision of ASTM C 28-30; ASA A49.3-1933)

Specifications for Weather-Resistant Saturants and Finishes for Rubber-Insulated Wire and Cable C8.19

Specifications for Heavy Wall Enamelled Round Copper Magnet Wire C8.20

Specifications for Timber Piles (O6; ASTM D 25-37)

Specifications for Structural Wood Joist and Planks, Beams and Stringers, and Posts and Timbers (O7; ASTM D 245-37)

Specifications for Copper Water Tube (Revision of H23.1-1934; ASTM B 88-33)

Specifications for Steel for Bridges and Buildings (Consolidation of G18-1938 and G19-1936; ASTM A 7-36 and A 9-36)

General Methods of Testing Woven Textile Fabrics (Revision of L5-1938; ASTM D 39-38)

Specifications for Forged or Rolled Steel Pipe Flanges for High-Temperature Service (Revision of G17.3-1936; ASTM A 105-36)

Specifications for Billet-Steel Concrete Reinforcement Bars (Revision of A50.1-1936; ASTM A 15-35)

Specifications for Zinc Oxide (Revision of K22-1937; ASTM D 79-24)

Specifications for Prussian Blue (Revision of K29-1937; ASTM D 261-28)

Withdrawal of Approval Requested

American Tentative Standard Specification for Class A 30% Rubber Insulation for Wire and Cable for General Purposes (C8.4-1936)

Standard Specifications for Brass Forging Rod (H7-1925; ASTM B15-18)